TRANSPORTATION RESEARCH
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FY98 Research Projects Selected

The Process:

The ITD Research Advisory Committee held their annual meeting on 15 August 1997 for the purpose of selecting new research projects to be included in the Fiscal Year 1998 Work Program.

Presentations were made by Clayton Sullivan, State Maintenance Engineer and Mitch Latta, Signal Shop Supervisor as well as by Michael Kyte, Director of the National Center for Advanced Transportation Technology (NCATT) at the University of Idaho. A total of ten projects were proposed, including eight submitted by NCATT.

Following the presentations, the Committee prioritized the projects. The top seven vote getters were included in the FY98 Work Program

The Chosen:

1. ***Integrated Erosion Control Methods for Highway Construction and Slope Maintenance, Phase III***
2. ***Optimal Statewide Road Weather Information System***
3. ***Traffic Signal Controller Interface***
4. ***Idaho Statewide Transportation Planning Model***
5. ***Micro-Strain Development Investigation***
6. ***Monitoring the In-Situ Stresses in the Goff Bridge.***
7. ***Development of ITD Design Standards for Integral Abutment Bridges***

Also included was one new project that had been selected at the 1996 RAC meeting, ***Economic Impact of Work-Zone Travel-Time Delays.***

The Objectives:

(RP127) ***Integrated Erosion Control Methods for Highway Construction and Slope Maintenance***. This would be Phase 3 of the current study. Charles Rountree, Environmental Manager talked about ongoing vegetation

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1997 WASHTO-RAC Hosted by Wyoming DOT

Research Implementation & Peer Exchanges Hot Topics

The 1997 WASHTO RAC meeting was hosted by the Wyoming DOT in Cody this Fall. The attendance of 38 included representatives from 12 of the 17 WASHTO states. The Editor of the Bulletin had the opportunity to represent Idaho.

The three-day program covered a wide range of topics and was very illuminating. A number of speakers from the FHWA, TRB, universities, consulting firms and member agencies provided insight into new legislation and emphasis areas, updates on support services and status of major research projects. General discussions were held on research implementation and funding procedures for pooled

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Bolt Study Leads to Clarification of ITD's Construction Specification

The 1995 research project, "Effect of Bolt Over-tightening on Bolted Connections," evaluated the effect on the strength of bolted connections of over-tightening high strength bolts to a Direct Tension Indicator zero-gap reading. This was a concern on the Lawyers Canyon Bridge as well as other steel bridges in the state. In general, the investigation showed no reduction in shear strength for the systematically over-tightened bolts.

According to Matt Farrar, Bridge Design Engineer, "Tightening high strength bolts according to specifications is crucial to the integrity of the bridge. As a result of the bolting research that was done under contract with the University of Idaho, a better understanding of the forces and factors of safety involved with Direct Tension Indicators (DTI's) was garnered by the Engineers of the

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studies and the relationship to erosion control efforts. There is an effort to use more native and deep-rooted plants. This type of study requires long term evaluations. The study involves several small monitoring contracts conducted over a number of years. A summary of the performance of species and treatments over the three-year project will be included in the final report. In addition, a handbook will be developed that will summarize characteristics and preferred environments of commonly-used grass, forb, shrub species used for roadside reclamation in Idaho.

(RP129) ***Economic Impact of Work-Zone Travel-Time Delays***. Better decisions regarding lane closures, detours, etc. could be made if the total costs of various options could be weighed against the benefits. The objective of this project is to determine if the travel-time cost model developed by the Univ. of Idaho as part of their winter maintenance level of service research project is applicable or if there are other existing models which would be more applicable. If feasible, a model would be developed to analyze the total costs and benefits of various traffic-control options

(RP133) ***Micro-strain Development Investigation***. Mitch Latta presented a proposed Phase 2 project to further develop micro-strain technology as an extension of work that has been previously done by Department staff. It involves the development of an integrated database using micro-strain technology to support WIM, vehicle identification, vehicle detection, etc. Initial prototype hardware has been developed under Phase 1. Phase 2 would finalize the research on algorithms and software and finalize the development of the prototype hardware for fourteen analog subsystems. This project involves new a technology, which could result in a new type of sensor costing about 10 percent as much as piezo-electric sensors. Mitch said that about 15 applications have been identified so far for this technology

(RP134) ***Traffic Signal Controller Interface***. Larry Van Over, Traffic Engineer gave a brief overview of the project. To date, traffic responsive traffic controllers have not been used in Idaho. Traffic-responsive control and other functions of advanced traffic signal controllers require well thought out design. Some popular signal optimization packages such as PASSER II-90 and TRANSYT 7F offer useful tools for determining timings that will reduce delay. The Arterial Analysis Package (AAP) offers use of these with the same input. The University of Idaho proposes to create an application that will ease translation of optimized signal timings from popular software packages into a format easily entered into the controllers most commonly used in Idaho. An investigation will also be conducted of the possibility of automating the process of traffic data collection, signal-parameter optimization and entry of optimized parameters into the controllers.

(RP135) ***Idaho Statewide Transportation Planning Model***. Phase 1, which was approved last year, was intended to determine the feasibility of a statewide model. Gary Sanderson, Planning Services Manager discussed the need for better traffic projections, the type of data that would be used, the comprehensive nature of the proposed model, and the tie in with our Geographical Information System (GIS). The integration of a GIS with traffic-demand modeling software has not been emphasized in other studies. The historically-based trend model which is used for statewide traffic projections has serious limitations for planning purposes. I addition to planning, this project is intended to address the need for accurate traffic data for 1) the assessment of environmental impacts related to transportation and 2) support of the Pavement Management System and Highway Performance Monitoring System.

(RP136) ***Monitoring the In-Situ Stresses in the Goff Bridge***. In addition to being one of the first tied-arch bridges approved by the FHWA since the 1980's, the Goff Bridge is the longest tied-arch bridge to be built in Idaho. Due to such innovative features as seismic dampers, the analysis and design were extremely complicated. Finally, since the bridge is statically indeterminate, the stresses are affected by the construction sequence, temperature changes, and traffic loadings. Due to the complex nature of the bridge, it is important to verify that the actual stresses in the bridge do not exceed the calculated values.

(RP137) ***Development of ITD Design Standards for Integral Abutment Bridges***. Integral abutments have become increasingly common in recent years, eliminating a source of corrosion and damage to bearings. However, because integral abutments have been adopted only fairly recently by ITD and many other transportation departments, there is no universal agreement regarding many of the design details. The problem is further complicated by the ongoing change to Load and Resistance Factor Design (LRFD). The objective of this project is the development of design practices for the load and resistance fact design of integral abutments.

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Current Departmental Research Meets Needs of Many Sections

There are currently 16 formal research projects being conducted by or for the Department in support of eight different Sections. These include five for Materials, four for Traffic, two for Bridge, and one each for Design, Environmental, Maintenance, Planning Services and Traffic Survey & Analysis. Some of the projects are in the early stages of development, while other are in final testing and implementation. A brief description of the status of each project follows.

RP 116A: "Development of Highway Design Visualization Technology, Training and Software Development." This project was initiated to develop CADDS training for ITD personnel and to develop the CADDS laboratory at the University of Idaho. A major product of this project has been the development of an automated plan sheet and quantity summary. Most recently the department changed operating systems to the Windows NT system. This has necessitated alterations in the plan sheet program. Beta testing of the UNIX based program is underway. The next step will be to develop a version that will run effectively under NT. Completion of the program is expected in FY 1999.

ITD Technical Contact: Warren Hostettler, Design, 208-334-8494

RP 116B: "Development of Machine Vision Technology, Training and Software Applications." This project was initiated to 1) develop the machine vision technology capability at the University of Idaho, 2) provide training in the use of video monitoring of traffic operations, and 3) develop portable video equipment for the use of both the University and the Department. Supplemental work has included evaluating alternative Autoscope systems and also additional data collection to validate and calibrate traffic flow simulation models. Completion of this project is anticipated in FY 1998.

ITD Technical Contact: Mike Boydstun, Traffic, 208-334-8569

RP 118: "Performance Evaluation of Pavement Inlays/Overlays." This in-house project is intended to provide information on the effectiveness of pavement rehabilitation treatments in achieving the expected design capacity, and to develop information regarding the deterioration rates and probable structural life of the rehabilitation treatments. To date, nearly 30 projects have been re-tested following construction, and in many cases they have been re-tested twice. Up til now, efforts on the project have been primarily involved in data gathering. We expect to begin some analysis during FY 1998, however to develop information on deterioration rates is expected to be a long term effort.

ITD Technical Contact: Bob Smith, Materials, 208-334-8437

RP 119: "Ground Penetrating Radar Test Sections." In October 1995, contracts were executed with two consulting firms offering ground penetrating radar services, but using different data acquisition methods. Eight pavement sections and three bridge decks in District 3 were surveyed by both consultants. The intent was to evaluate the accuracy of the surveys in comparison to core data. The data acquired included pavement layer thicknesses, relative subgrade moisture, overlay thickness and also depth to rebar in and degree of delamination in bridge decks.

Both consultants have submitted final reports. To evaluate the results and compare the two radar systems, we have requested a scope of services and budget from Joseph Sener at Boise State University.

ITD Technical Contact: Bob Smith, Materials, 208-334-8437

RP 120: "Seasonal Deflection Testing." This in-house project involves periodic deflection testing of seven approximately 0.2 mile-long test sections on recent newly constructed pavement sections in District 3. The sections, which were chosen, represent different subgrade and base types, as well as different pavement thicknesses. A rock-cap section and a section with geogrid are included. The data will be analyzed to compare pavement temperature - modulus relationships with published curves and to evaluate the variation in support at different times of the year. Project activity during this year consists primarily of data gathering.

ITD Technical Contact: Bob Smith, Materials, 208-334-8437

RP 121, Phase II: "Upgrade of Idaho Overlay Design Program, Flexolay and Design Manual." Currently, ITD is beta testing a Windows NT/95 compatible program (WINFLEX). The intent is to provide a rehabilitation design program that is user-friendly, comprehensive and flexible enough to allow a number of

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different pavement rehabilitation strategies. We expect delivery of the program early in FY 1998.

ITD Technical Contact: Bob Smith, Materials, 208-334-8437

RP 122: "Pre-stressed Bridge Girder Design Software - Upgrade." The previously developed program has been updated to include metric dimensions, new code requirements and an on-line help screen. The project is complete and the program is in use in the Bridge Section. The final report has been received and following technical committee review, it will be ready to publish.

ITD Technical Contact: Matt Farrar, Bridge, 208-334-8538

RP 123: "Applications of Machine Vision Technology." The project includes testing and evaluation of improvements to the electronics of the signal controller hardware, tests of changes to the signal controller algorithm and development of advanced traffic data collection techniques. Currently, two intersections in Moscow are instrumented with video detection equipment. More recently, the signal in front of the Headquarters Building has been instrumented with video actuation control. The project is scheduled for completion in June 1998.

ITD Technical Contact, Mike Boydstun, Traffic, 208-334-88569

RP 124, Phase II: "Monitoring and Modeling Subgrade Soil Moisture." This project is intended to monitor and evaluate moisture conditions in the subgrade and base in pavement sections constructed with both "Rock Cap" and crushed aggregate base. Frost depth, soil temperature and deflection measurements will be included. With these data, we will evaluate the value of the "Rock Cap" in increasing pavement life and in allowing a thinner surface course. Most of the instrumentation has been purchased. Completion is scheduled for FY 1999-2000.

ITD Technical Contact: Bob Smith, Materials, 208-334-8437

RP125: "Winter Maintenance Complement Prediction Model - Update." This project updated the previously developed Winter Maintenance Complement prediction model to include five additional years of data since 1990. Also updated were the traffic volumes and level of service to 1994 values. The project is complete and the report is awaiting final editing and publication. The findings were presented to the Department Complement Team.

ITD Technical Contact: Clayton Sullivan, Maintenance, 208-334-8405

RP 126: "Video Based Traffic Data Collection System." This project is intended to develop a pilot study to use the video data collection system to assist ITD in it on-going data collection effort. The project will train students in the use of the video equipment to collect traffic data and establish a northern Idaho data collection program .

ITD Technical Contact: Glenda Fuller, Traffic Survey & Analysis, 208-334-8217

RP 127: "Integrated Erosion Control Methods for Highway Construction and Slope Maintenance." This project is a multidisciplinary program to address surface erosion, sediment transport and shallow slope failures common in highway construction. It is to provide novel approaches to erosion control and provide technical guidance for enhanced design and rehabilitation of highway slopes. Treatments include low maintenance vegetation, different methods of increasing the rate of germination and growth, and engineering evaluations of slope geometry and economical reinforcement techniques. Two vegetation test sites have been established in highly erodible soils.; one near Moscow and one near Sandpoint. Additional shrub planting sites near Weiser and Sandpoint have been established. Phases 1 and 2 are underway.

ITD Technical Contact: Charlie Rountree, Environmental, 208-334-8484

RP 128 "Camber Growth in Pre-stressed Concrete Bridge Girders." Recently Idaho tightened the specifications regarding camber growth in pre-stressed concrete girders. Some of the manufacturers claim that Idaho's method of calculating camber does not reflect current industry practice. This project will survey surrounding states, make field measurements of camber growth at pre-stress plants which supply Idaho and make a statistical evaluation leading to the development of a new camber growth factor. The project was initiated in June 1997 and is expected to take one year to complete.

ITD Technical Contact: Matt Farrar, Bridge, 208-334-8538

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97 WASHTO-RAC (Cont. from Page I, Col. 2)

fund studies. Two states that have recently participated in peer exchanges shared their experiences. Finally, each state gave an overview of their research program, including the status of current research projects and innovative tools or procedures they have developed.

National Perspectives:

Two speakers were present from FHWA headquarters. Dr. Anne Brach from the Turner-Fairbank Highway Research Center spoke about what's **hot** at Turner-Fairbanks. These include: high performance materials, non-destructive evaluation, the intelligent vehicle initiative, SUPERPAVE, and the Interactive Highway Safety Design Model. She also addressed the issue of reauthorization and the potential impacts of the various bills on the research program. The various reauthorization bills that have been introduced appear to maintain comparable levels of funding for existing programs. Mike Halladay of the Office of Technology Applications presented a short list of projects that are in various stages of deployment. In reference to reauthorization, OTA feels that whichever final legislative package is chosen, the programs will be "Customer Driven."

Two speakers also represented the Transportation Research Board. Ray Derr from the National Cooperative Highway Research Program provided the NCHRP perspective. He highlighted a number of Special Projects. Ray also discussed the new NCHRP home Page at **www2.nas.edu/trbcrp**. Some of its features include: 1) a search engine, 2) all research projects since 1988, 3) Project Statements (RFP's), 4) anticipated projects, 5) CRP publication lists and ordering information, 6) registration form for receipt of RFP's, and 7) the form for submittal of "Success Stories." RFP's will no longer be published. Jerry Maddock, addressed issues surrounding the Transportation Research Information System (TRIS) in general and Research in Progress (RIP) in particular. All States have equipment and software for direct access to the new TRIS Server. The RIP Web Site is now available at **www3.nas.edu/rips**. Major ongoing issues involve 1) uploading and downloading, 2) the lack of continued funding for maintenance, development and user support, 3) the need for improved local printing capability, and 4) the current low level of reporting by the states of research in progress. There are a number of enhancements proposed or under development for the system.

Research Implementation General Discussion:

The subject of implementation of research results was of great interest to the states assembled. Several states made presentations on their approach to improving implementation.

Colorado is developing an implementation procedure with the following elements:

1. Draft implementation plan required with project proposal,
2. Identified products listed in objective of project,
3. Divisional level sign off required on implementation plan,
4. Follow-up milestones required,
5. Commitment to field test results needed,
6. Report to management on status of implementation,
7. Need champion for project who has credibility within the Department, authority to make change, and
8. Need checklist of implementation issues for pre-proposal meeting.

Oregon is in the process of re-evaluating their research program. Their goals include:

1. More project milestones (review of report outline & early review of chapters),
2. Better experiment design,
3. A streamlined process, and
4. Better anticipation of research needs.

Utah has made access to their ongoing projects available on their home page. They have developed implementation strategies that encompass the following elements:

1. Technical Advisory Committees for research projects,
2. Visibility via their research newsletter,
3. Training sessions to expose personnel to new practices,
4. Project final reports,
5. Standards Committee involvement,
6. Specification revisions,
7. Demonstrations and experimental projects,
8. Quality Teams,
9. News Releases, and
10. New Products Panels.

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Washington's implementation procedures include the following elements:

1. Draft Implementation Plan must be provided at proposal pre-conference meeting,
2. Implementation Plan must be submitted with draft report, and
3. 18-Month follow-up report required.

Peer Exchange Experiences:

One of the hot issues in the coming year will be Peer Reviews. To date, none of the states in Region 10 have conducted a Peer Review. Montana and Wyoming have recently gone through Peer Reviews and provided a great deal of insight into the process.

Montana research staff came up with an initial set of issues and had it reviewed by their RAC. Highlights of their review include:

1. Montana invited team members including neighboring states, FHWA and outside research organizations.
2. Team members reviewed documentation describing Montana's program.
3. Team met and discussed procedures.
4. Team developed questions.
5. Team interviewed Sections, Districts, and University staff.
6. Each team member developed a list of planned actions.
7. Montana developed a timeline for each of their action items.

Wyoming invited their RAC to attend the presentation of the final report by the team members. They suggested that inviting the FHWA State Administrator to attend the final briefing would ensure that an appropriate level of emphasis was placed on the process.

FY98 Research (Cont. from Page II, Col. 2)

(RP138) ***Optimal Statewide Road Weather Information System (RWIS)***. Clayton Sullivan discussed the proposed project that would allow utilizing remote sensors to gather snow and ice conditions to use as a basis for deploying winter maintenance forces. The SHRP program and other post-SHRP experiences have proven that a well planned, designed and operated Road Weather Information System (RWIS) in conjunction with the use of modern deicing/anti-icing chemicals can significantly increase winter-maintenance service levels and decrease maintenance costs. Clayton explained that anti-icing involves getting chemicals on road before snow and ice forms to prevent bonding. Currently, the locations of remote weather stations and sensors are based on staff opinion. They need to be strategically located to ensure optimal locations and improve information generated.

Weathering Steel Report Published

Some states have reported problems with excessive corrosion of unpainted A588 weathering steel bridges. Weathering steels develop a protective oxide coating that shields the underlying steel base from further corrosion when certain conditions are met. Considerable savings in initial and life cycle costs are anticipated when using weathering steel, but only if good long -range performance is attained.

Following discovery of advanced corrosion inside a weathering steel box beam on the Perrine Bridge, ITD - under the direction of former State Bridge Engineer Dick Jobes - conducted its first in-depth study of a representative group of 12 weathering steel bridges to determine their present condition. All weathering steel bridges in Idaho were identified and current inspection reports were reviewed. Data collected from the field inspections includes: visual observations of the conditions of the protective oxide coating (color, texture, adherence), conditions and details that cause corrosion problems, and plate thickness measurements with an ultrasonic gage. Samples of the oxide coating were tested for chlorides.

Field inspections indicate the unpainted weathering steel on the bridges inspected is performing very well. Small areas of localized corrosion were found on four bridges. These problems can be corrected with proper design and maintenance. Continued use of unpainted weathering steel in bridges appears justified.

Improving Idaho's Roads: 10 Years of Collaborative Research

For the past decade, University of Idaho and the Idaho Transportation Department have been collaborating in research efforts to improve the state's transportation infrastructure. "Our goal is to solve real transportation problems for Idaho," said Michael Kyte, director of the **National Center for Advanced Transportation Technology (NCATT)** at UI. "Our expertise in traffic, structural, materials and geotechnical engineering, along with ITD's support, has made it possible for us to provide solutions that have benefited the state in many ways."

University faculty and students, in partnership with ITD, have conducted numerous studies over the years. They've developed strategies to reduce traffic congestion and designed methods to minimize delays at intersections by optimizing signal control. Highway designers throughout Idaho and the nation are now using these procedures to analyze unsignalized intersections. To alert motorists of dangerous driving conditions, NCATT researchers worked with ITD to test and develop the first Intelligent Transportation System in Idaho that electronically posts warning messages on roadway signs. They have been installed along one of southern Idaho's most hazardous highway sections, notifying drivers of impending storms, speed advisories and road closures. This system may eventually be used in other areas of the state as well. In northern Idaho, university structural engineers were asked by the state to determine if over-tightened bolts in the newly constructed Lawyer Canyon Bridge compromised its safety. (See **Bolt Study** - pg.1)

"Applied research is our primary interest," said Bob Smith, ITD's research director. "Something that solves a problem and provides us with a tool that we can use right away. And that's what we've been able to do with the university's research."

A high priority for the state, Smith adds, is research that reduces highway construction and maintenance costs. The university has worked closely with ITD to achieve this in a number of ways. New software tools for more efficient pavement maintenance and rehabilitation alternatives have been, or will soon be implemented. In addition, UI civil engineers are installing sensors in pavement sections to measure moisture content and temperature changes. This study will help determine if thinner asphalt surfaces are possible in some sections where subsurface drainage is improved, which would reduce costs.

Ongoing studies to improve bank stabilization and soil erosion control along roadways will also reduce maintenance cost. UI researchers have been investigating the use of new products and technologies for erosion control and slope stability. This will help protect water quality along roadways and make it easier and less costly to maintain road slopes and ditches.

Another software tool that Smith and university researchers believe will have big payoffs for the state is AutoPayItem. It is a highway design software tool to improve the state's roadway design application procedures. Currently, engineers must manually input up to 1,500 pay items (tons of asphalt, guard railing, light fixtures and so on) into plan sheets, which they then have to summarize by hand. This labor-intensive system is costly and prone to error. AutoPayItem will automate this process, reducing errors, time and costs. Early test results from one district show both time and miscalculations have been reduced by up to 75 percent.

Cooperative research between the university and the state has paid many dividends. With more efficient highway management and planning tools, ITD is better prepared to handle the growing needs of the state under limited resources. And it gives UI faculty the opportunity to engage in innovative research that encourages professional growth and gives their students practical research experience.

by Joanne Buteau

Condensed from article in **Idaho Magazine,** Winter'98
official publication of the University of Idaho

Bolt Study (Cont. from Page I, Col. 2)

Bridge Design Section." This led to a clarification of the 1995 **ITD Standard Specifications for Highway Construction** that reflected the findings of the research project.

The following statements were added to the Structural Metals Section of the Standard Specifications. …*"A nil gap condition may be cause for rejection. The Engineer may require any bolt with nil gap to be removed from the work and the bolt thread examined at no additional cost. If no necking is observed and the nut can be run down the full length of the thread, then the bolt can be reinstalled with new DTI's."*

Current Research (Cont. from Page IV, Col. 2)

RP 130, "Statewide and Sub-Area Transportation Model Feasibility." The objective of this project is to investigate the feasibility of developing a PC based, multi-modal transportation model to facilitate statewide and regional transportation planning. The model would need to have the ability to integrate with the existing transportation planning models used by the Metropolitan Planning Organizations. The feasibility study is currently scheduled for completion in the Fall 1997.

ITD Technical Contact, Gary Sanderson, Planning Services, 208-334-8211

RP 131, "Development of a Micro-station Tool to Compute Circuit Requirements for Lighting Design." The objective of this study is to develop a Micro-station application to 1) calculate circuit requirements for various electrical circuits in illumination and signalization, 2) create tagged element data from the design , 3) develop a database, and 4) create conductor / circuit schedule and material-quantity plan sheets with cost estimates. Completion is currently scheduled for Fall 1997.

ITD Technical Contact: Terry McAdam, Traffic, 208-334-8494

RP 132: "Control Strategy for Signalized Intersections." The objective of this study is to provide ITD with traffic simulation and optimization models, tested and validated with Idaho field data, that will assist the Department in implementing and evaluating new signal timings that can be down-loaded directly to traffic signal controllers. The US 95 corridor through Coeur d'Alene was chosen as one source of the data. This project is scheduled to run for two years with completion scheduled for October 1998.

ITD Technical Contact: Mike Boydstun, Traffic, 208-334-88569

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Letters or articles are welcome.

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